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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

DUONG, KHANH B

ART UNIT PAPER NUMBER

2822

DATE MAILED: 10/06/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/687,197

Applicant(s)

MARUO, YUTAKA

Examiner

Khanh Duong

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 05 August 2003.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 4, 5, 30 and 32-46 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) 30 and 32-46 is/are allowed.
- 6) ☒ Claim(s) 4 and 5 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on September 8, 2003 has been entered.

Response to Amendment

This Office Action is in response to the Preliminary Amendment filed on September 8, 2003.

Accordingly, claims 4, 30 and 32-34 were amended, claims 1-3, 6-29 and 31 were canceled, and new claims 36-46 were added.

Currently, claims 4, 5, 30 and 32-46 are pending in the application.

Response to Arguments

Applicant's arguments with respect to the rejections based on Manning and other secondary references presented in the previous Office Action, Paper No. 11, have been considered but are moot in view of the new ground(s) of rejection.

However, Applicant's arguments with respect to the rejections of claims 28, 30 and 35, under *35 USC § 112* have been fully considered and are persuasive. Therefore, the rejection of the claims has been withdrawn.

Claim Objections

Claims 34, 36 and 44 are objected to because of the following informalities:

Re claim 34, line 13, claim 36, line 14, and claim 44, line 12, before "insulating layer",
"a" should be --an--.

Re claim 44, line 17-18, the last step should be anteceded by --and--.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all
obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459
(1966), that are applied for establishing a background for determining obviousness under 35
U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

**Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over
Hwang et al. (US 6,329,266) in view of Rogers et al. (US 4,571,819), both references were
cited in Paper No. 8.**

Hwang et al. discloses a method of manufacturing a semiconductor device (see Figs. 1-7
and accompanying text) comprising the steps of: forming a polishing stopper layer 202b over a
substrate 200, the polishing stopper layer 202b having a predetermined pattern for a chemical-
mechanical polishing; removing a part of the substrate 200 using a mask layer 202 including at

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least the polishing stopper layer 202b as a mask to form a trench 203; forming a trench oxide film 204 over a surface of the substrate 200 that forms the trench 203; forming an etching stopper layer 205 (silicon nitride, 30-60 nm) for the trench oxide film 203 over at least a portion of the trench oxide film 203; forming an insulating layer 206 that fills the trench 203 over an entire surface of the substrate 200; polishing the insulating layer 206 by a chemical-mechanical polishing; and removing the polishing stopper layer 202b.

Re claim 4, Hwang et al. fails to disclose etching a part of the insulating layer to form a trench insulating layer.

Rogers et al. suggests in FIG. 6 using a selective wet chemical etchant such as buffered HF or a dry etching such as RIE with CHF_3 to etch a part of the insulating layer OXIDE-19, along with the etching stopper layer NITRIDE-18, to form a trench insulating layer, wherein the etching stopper layer NITRIDE-18 is inherently more resistant to the etching than the insulating layer OXIDE-19 (see col. 6, lines 44-55).

Since Hwang et al. and Rogers et al. are both from the same field of forming trench isolation structures, the purpose disclosed by Rogers et al. would have been recognized in the pertinent prior art of Hwang et al..

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Hwang et al. as suggested by Rogers et al., since Rogers et al. states at column 1, line 44-45 that such modification would provide trench isolation regions having a surface level or below the surface of the polysilicon etch-stop/buffer layer.

Re claim 5, it would have been obvious to one of ordinary skill in the art at the time the invention was made to select a thickness for the silicon nitride etching stopper layer within the

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range as taught by Hwang et al., since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Allowable Subject Matter

Claims 34, 36, 44 and their dependend claims would be allowable if rewritten or amended to overcome the objection(s) set forth in this Office action.

Claims 30 and 32-46 are allowed.

The following is a statement of reasons for the indication of allowable subject matter: none of the prior art of record fairly shows or suggests all the process limitations as claimed. Specifically,

Re claim 32, none of the prior art of record discloses, in addition to other process steps or elements, the steps of: *after the etching of the insulating layer, implanting an impurity into a first region of the silicon substrate, implanting an impurity into a second region of the silicon substrate, and after the implanting the impurity into the second region, etching the second portion of the insulating layer, wherein the etching is controlled so that the second portion of the insulating layer extends to a level above that of the upper surface of the substrate.*

Re claim 34, none of the prior art of record discloses, in addition to other process steps or elements, the steps of: *etching the remaining pad insulation layer and the insulation layer so that a portion of the insulating layer extends to a level higher than that of the silicon layer; and performing at least one ion implantation while the insulation layer extends to a level higher than that of the silicon substrate.*

Re claim 36, none of the prior art of record discloses, in addition to other process steps or elements, the steps of: *after the etching the polishing stopper layer, etching the remaining pad insulation layer and the insulating layer so that a portion of the insulating layer remains at a level higher than that of the silicon substrate and the etch stop layer; and performing at least one ion implantation into the silicon substrate while the insulation layer extends to a level higher than that of the silicon substrate and the etch stop layer.*

Re claim 44, none of the prior art of record discloses, in addition to other process steps or elements, the steps of: *planarizing the insulating layer that overfills the trench to a level that exposes the polishing stopper layer; after the planarizing, etching the polishing stopper layer and the etch stop layer so that the polishing stopper layer is removed and the etch stop layer on the side surfaces of the polishing stopper layer is removed; and after the etching the polishing stopper layer and the etch stop layer, etching the remaining pad insulation layer and the insulating layer so that a portion of the insulating layer remains at a level higher than that of the silicon substrate and the etch stop layer.*

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khanh Duong whose telephone number is (703) 305-1784. The examiner can normally be reached on Monday - Friday (9:00 AM - 6:00 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian, can be reached on (703) 308-4905. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 305-3431 for regular communications and (703) 308-7722 for After Final communications.


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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.



KBD

September 29, 2003



AMIR ZARABIAN
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